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ABSTRACT

Two learning strategies, visual imagery and self questioning, designed to increase reading comprehension were taught to six learning disabled (LD) secondary students. The Visual Imagery Strategy required the student to read a passage and to create visual images representative of the content; while the Self Questioning Strategy taught the student to form questions about the content of the passage read to maintain interest and enhance recall. Specific instructional procedures included: testing student's current level of functioning, describing the strategy, modeling the strategy, practice in reading ability level material, and practice in grade level material. Results indicated that LD students can learn the two strategies and can apply them in both reading ability level and grade level materials. Students' use of strategies resulted in greater comprehension scores from the pretest in baseline to the posttest after training. Charts with statistical data are included. (Author/SB)

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VISUAL IMAGERY AND SELF-QUESTIONING: STRATEGIES TO IMPROVE COMPREHENSION OF WRITTEN MATERIAL

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The University of Kansas Institute for Research in Learning Disabilities is supported by a contract (#300-77-0494) with the Bureau of Education for the Handicapped, Department of Health, Education, and Welfare, U. S. Office of Education, through Title VI-G of Public Law 91-230. The University of Kansas Institute, a joint research effort involving the Department of Special Education and the Bureau of Child Research, has specified the learning disabled adolescent and young adult as the target population. The major responsibility of the Institute is to develop effective means of identifying learning disabled populations at the secondary level and to construct interventions that will have an effect upon school performance and life adjustment. Many areas of research have been designed to study the problems of LD adolescents and young adults in both school and non-school settings (e.g., employment, juvenile justice, military, etc.)

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COOPERATING AGENCIES

Were it not for the cooperation of many agencies in the public and private sector, the research efforts of The University of Kansas Institute for Research in Learning Disabilities could not be conducted. The Institute has maintained an on-going dialogue with participating school districts and agencies to give focus to the research questions and issues that we address as an Institute. We see this dialogue as a means of reducing the gap between research and practice. This communication also allows us to design procedures that: (a) protect the LD adolescent or young adult, (b) disrupt the on-going program as little as possible, and (c) provide appropriate research data.

The majority of our research to this time has been conducted in public school settings in both Kansas and Missouri. School districts in Kansas which have or currently are participating in various studies include: Unified School District USD 384, Blue Valley; USD 500, Kansas City, Kansas; USD 469, Lansing; USD 497, Lawrence; USD 453, Leavenworth; USD 233, Olathe; USD 305, Salina; USD 450, Shawnee Heights; USD 512, Shawnee Mission; USD 464, Tonganoxie; USD 202, Turner; and USD 501, Topeka. Studies are also being conducted in several school districts in Missouri, including Center School District, Kansas City, Missouri; the New School for Human Education, Kansas City, Missouri; the Kansas City, Missouri School District; the Raytown, Missouri School District; and the School District of St. Joseph, St. Joseph, Missouri. Other participating districts include: Delta County, Colorado School District; Montrose County, Colorado School District; Elkhart Community Schools, Elkhart, Indiana; and Beaverton School District, Beaverton, Oregon. Many Child Service Demonstration Centers throughout the country have also contributed to our efforts.

Agencies currently participating in research in the juvenile justice system are the Overland Park, Kansas Youth Diversion Project, and the Douglas, Johnson, Leavenworth, and Sedgwick County, Kansas Juvenile Courts. Other agencies which have participated in out-of-school studies are: Penn House and Achievement Place of Lawrence, Kansas; Kansas State Industrial Reformatory, Hutchinson, Kansas; the U. S. Military; and Job Corps. Numerous employers in the public and private sector have also aided us with studies in employment.

While the agencies mentioned above allowed us to contact individuals and support our efforts, the cooperation of those individuals--LD adolescents and young adults; parents; professionals in education, the criminal justice system, the business community, and the military--have provided the valuable data for our research. This information will assist us in our research endeavors that have the potential of yielding greatest payoff for interventions with the LD adolescent and young adult.

ABSTRACT

Two learning strategies, visual imagery and self-questioning, designed to increase reading comprehension were taught to six learning disabled students using a multiple-baseline across strategies design. The Visual Imagery Strategy requires the student to read a passage and to create visual images representative of the content of the passage. The Self-Questioning Strategy teaches the student to form questions about the content of a passage as s/he reads to maintain interest and enhance recall. Specific instructional procedures were followed that included: (a) testing the student's current level of functioning, (b) describing the strategy, (c) modeling the strategy, (d) practice in reading-ability level material, and (e) practice in grade-level material.

Results of the study indicate that LD students can learn the two strategies and can apply them in both reading-ability level and grade-level materials. The students' use of the strategies resulted in greater comprehension scores from the pretest in baseline to the posttest after training. Instructional time for each strategy ranged from five to seven hours.

VISUAL IMAGERY AND SELF-QUESTIONING:
STRATEGIES TO IMPROVE COMPREHENSION OF WRITTEN MATERIAL

In recent years, the number of educational programs for learning disabled (LD) adolescents has increased substantially. The problems of these individuals, many of whom received services during their elementary school years, have persisted into adolescence (Alley & Deshler, 1979; Anderson, 1970; Deshler, 1978; Siegel, 1974). As programs for LD adolescents were designed, they were patterned initially after those programs designed for elementary school-aged children and emphasized basic skills remediation. However, a growing awareness of the differences between elementary and secondary school curriculum and settings caused educators to explore other alternatives, such as functional curriculum, tutorial, work-study and learning strategies approaches (Deshler, Lowrey, & Alley, 1979). For example, in secondary schools as opposed to elementary schools, the emphasis is on content acquisition. Great demands are placed on students' skills in acquiring information from both written and oral material and in presenting information in writing.

One approach to meeting the needs of many LD adolescents is a learning strategies model (Alley & Deshler, 1979). Learning strategies are "techniques, principles, or rules that will facilitate the acquisition, manipulation, integration, storage, and retrieval of information across situations and settings" (p. 13). Learning strategies are important not only in helping LD students cope with the demands of the secondary school setting, but also in preparing them for the demands of a rapidly changing and highly technical society. Toffler (1970) emphasized the transitory nature of knowledge and concluded that students must "learn how to learn" (p. 414). Learning strategies, rather than teaching specific content, teach students how to learn that content.

A major advantage of strategy learning is that it allows the student to learn a strategy and use it to attack situations not previously encountered (Becker, Engelmann, & Thomas, 1971; Engelmann, 1969; Rohwer, 1970).

Current research by investigators at The University of Kansas Institute for Research in Learning Disabilities (IRLD) and their colleagues has focused on the identification of secondary school curriculum demands (Keimig, 1980; Link, 1980; Moran, 1980) and the development of learning strategies that allow secondary LD students to cope with these demands. Strategies such as visual imagery, self-questioning, paraphrasing, multipass (for reading comprehension) (Schumaker, Deshler, Denton, Alley, Clark & Warner 1981), test-taking (Lee & Alley, 1981), and error monitoring (Schumaker, Deshler, Nolan, Clark, Alley, & Warner, 1981) are being studied. This paper will report two aspects of the intervention effort, specifically, implementation of visual imagery and self-questioning strategies to improve reading comprehension.

Visual Imagery

Visual imagery has been studied by reading experts for over two decades (Durrell, 1955). As a cognitive strategy it involves making associations between stimulus items and generating a visual image of the items or of an interaction between the items. Paivio (1969) found imagery to be important across a variety of experimental learning and memory tasks. Lesgold, McCormick, and Golinkoff (1975) found that imagery training facilitated recall of phrase content and concluded that its effects were in the areas of organization and storage of information. These positive results of imagery strategies were supported by Kerst and Levin (1973). Both student-generated and experimenter-generated strategies (imagery and sentences) facilitated recall, both immediately and over time (one week later). No differences were found in results when students produced their own strategies and when one was provided for them,

although greater variability was found in the student-generated strategies. The authors concluded that some students who may be unable to produce their own learning strategy can benefit from having that strategy provided.

Warner (1977) investigated the effectiveness of visual imagery in improving reading comprehension of LD junior high school students. Use of visual imagery as a learning strategy by these students yielded positive but nonsignificant increases in comprehension. However, he concluded that more frequent teaching sessions might yield more positive results.

Questioning

Questioning strategies have also been used to facilitate comprehension of written material. Questioning has been discussed both as a guide to comprehension in content areas (Miller, 1973; Niles, 1965) and to increase student involvement in the teaching process (Hoover, 1976). Questioning techniques were used in the SQ3R study method (Robinson, 1946) and later served as the basis for Manzo's ReQuest procedure (1969). Feldhusen, Houtz, and Ringenbach (1972) identified questioning as a subcomponent of problem-solving. In their problem-solving model, questioning aids the student in making discriminations necessary for reading comprehension. Research conducted with educable mentally retarded adolescents has demonstrated that questioning can be taught (Knapczyk & Livingston, 1974; Rinke, 1975).

Manzo's reciprocal questioning procedure, ReQuest, is designed to improve reading comprehension and questioning behaviors. Central to the ReQuest procedure is a modeling technique. The student learns to ask questions about the text and set his/her purpose for reading. Initially, the teacher models questions for the student and provides feedback about the student's questions. Manzo found the ReQuest procedure to be superior to a Directed Reading Activity in improving reading comprehension of students (ranging in age from 7 to 26)

in a summer remedial reading clinic. Not only were gains noted in reading comprehension, but differences in the frequency and type of questions also were evident.

Hori (1977) modified the ReQuest procedure for use with a small group of junior high school LD students. She used the questioning procedure and categories outlined by Manzo to guide the student through the material until he/she was able to state the outcome of the passage. She concluded that reading comprehension of LD students can be efficiently increased by using the ReQuest procedure. She concluded that "the questioning procedure can be quickly learned by the student and does not require an inordinate amount of teacher time" (p. 38).

Wong (1980) investigated the effectiveness of a questioning procedure on comprehension and retention of implied information with LD students. She found that use of a question/prompt procedure resulted in significant increases in comprehension and retention. The procedure was as effective with second grade LD students as with sixth grade LD students. Their performance, when given structured questions/prompts equalled that of good readers. Wong concluded that the questions/prompts stimulated the LD students to process the content of the sentences and, thus, improve their recall of implied information.

Summary

Research has shown that both visual imagery and questioning can be taught and are effective in facilitating reading comprehension. In addition, they appear to be efficient in terms of teacher and student time to achieve mastery of the procedures. To date, however, most of the research conducted with LD students in visual imagery has been inconclusive and has been conducted in experimental settings. Slightly more attention has been directed toward the use of questioning techniques in increasing comprehension of LD students. With the exception of Hori's study, this research has not been conducted in applied settings.

The purpose of this study was to apply a specific instructional methodology to teach two learning strategies: visual imagery and self-questioning. The effectiveness of these strategies in helping students meet the demands of the regular secondary school curriculum was measured by assessing the students' application of the strategies in regular class materials.

Method

Subjects

Six secondary students, three males and three females, participated. All of the students were being served in special education programs for the learning disabled in their schools. The students' school records were reviewed and their teachers were interviewed. Only those students having IQs in the normal range (i.e., above 80), exhibiting deficits in one or more achievement areas, and not exhibiting any evidence of physical or sensory handicaps, emotional disturbance, or economic, environmental, or cultural disadvantage were included. The sample included one eighth grader, four ninth graders, and one eleventh grader. The students selected had IQs ranging from 81 to 103 ($\bar{x}$ = 92.8). Their reading achievement grade level scores ranged from 4.1 to 7.3 ($\bar{x}$ = 5.8); their math achievement grade level scores ranged from 3.9 to 6.6 ($\bar{x}$ = 5.0); and their writing achievement grade level scores ranged from 3.5 to 6.9 ($\bar{x}$ = 5.1). The students' ages ranged from 13 years, 7 months to 17 years, 7 months with a mean age of 16 years, 1 month. The procedures of this study were described to the students and their parents, and written consent was obtained.

Setting

The study took place in a classroom adjacent to a learning center in a public school. Each student was seated at a small table along with his/her teacher in an area isolated from other students and teachers.

Instructional Materials

Each teacher was provided with three notebooks. One contained a step-by-step description of the instructional procedures for the Visual Imagery Strategy, one contained a similar description of the Self-Questioning strategy, and one served as a file for records of the students' progress. Two sets of reading materials were provided for each student. The first set included reading passages at the student's reading ability level as determined by a recently administered achievement test. The second set of reading materials included reading passages at the student's current grade placement level (See Note 1).

All reading materials for Visual Imagery Strategy instruction were selected for their "imageable" content, i.e., the materials had to lend themselves to forming visual images as passages were read. Passages related to abstract concepts, often not easily imaged, were not used for this strategy. No other special attributes characterized the materials used in this study (See Note 1).

Procedures

General procedures. Each student received individual instruction from a teacher. The two teachers involved were certified LD teachers with a minimum of 7 years of teaching experience. Both teachers had Master's Degrees. The teachers had written the instructional materials for the strategies and were well-versed in the procedures. They were supervised by senior investigators from the IRLD Core Staff. Thus, procedural questions were resolved without delay. The students met with their teachers for periods of time ranging from one to two hours in length. Depending on their schedules, some met daily and others met once a week.

Instructional procedures. The instructional steps used to teach visual imagery and self-questioning were adapted for use from those outlined by Alley and Deshler (1979) and Deshler, Alley, Warner, and Schumaker (in press). They are as follows:

Step 1: Test

In this step, the teacher tested either the student's visual imagery or self-questioning skills in both sets of materials (reading ability level and grade level). After testing was completed, the teacher discussed the results with the student, affirming that the student exhibited a deficit in the way s/he interacted with the materials and, as a result, in the way s/he was able to recall the information.

Step 2: Describe the Learning Strategy

Next, the teacher described the steps involved in the visual imagery or self-questioning strategy to the student. These steps included the specific behaviors in which the student should engage and the sequence of behaviors that should be followed. As each step was explained, a rationale was given for that behavior and how it would help the student to engage in the strategy.

Step 3: Model the Strategy

In this step, the teacher modeled the visual imagery or self-questioning strategy for the student. Thus, the teacher demonstrated the strategy by acting-out each of the steps previously described to the student while "thinking aloud" so the student could witness all of the processes involved in the strategy.

Step 4: Verbal Rehearsal of the Strategy

Here the student verbally rehearsed the steps involved in the visual imagery or self-questioning strategy to a criterion of 100% correct without prompts. This instructional step is designed to familiarize the student with the steps of the strategy so that s/he can instruct him/herself in the future as to what to do next when performing a strategy.

Step 5. Practice in Controlled Materials

In this instructional step, the student practiced applying the strategy in materials written at his/her current reading level. This reduced the demands on the student so that s/he could concentrate on the learning of the new strategy. As the student became proficient in the strategy, s/he was encouraged to progress from overt self-instruction to covert self-instruction while practicing the strategy.

Step 6: Feedback

As the student applied the strategy, the teacher gave the student both positive and corrective feedback. Steps 5 and 6 were repeated with additional materials until the student learned to use the strategy to a specified criterion.

Step 7: Practice in Grade-Level Materials

When the student reached criterion in the controlled materials, s/he was instructed by the teacher to apply the strategy to materials at his/her grade placement level.

Step 8: Feedback

As the student practiced in the grade-level materials, the teacher gave the student both positive and corrective feedback about his/her performance. Steps 7 and 8 were repeated until the strategy was mastered to a specified criterion.

Step 9: Test

The same tests administered during Step 1 were given to the student again using different materials. This gave a measure of each student's progress in learning the strategy. If indicated by the test results, review of the strategy was conducted again by repeating Steps 7 and 8.

Visual imagery strategy procedures. The Visual Imagery Strategy was designed to facilitate reading comprehension by requiring the student to read a passage and to create visual images representative of the content of the passage. The student followed these procedures:

1. READ Read the first sentence.
2. IMAGE Try to make an image--a picture in your mind.
3. DESCRIBE Describe your image.
   a. If you cannot make an image, explain why you cannot and go on to the next sentence.
   b. If you can make an image, decide if it is the same as an old image (one held in memory from the most recent image), the old image changed somewhat, or an entirely new image (not at all similar to the most recent memory image). A changed image may be made by adding or subtracting things from the picture you had in your mind before. Pictures may change as you continue reading a story.
   c. If you have an image, describe it.

4. EVALUATE Evaluate your image for its completeness.

   a. As you describe your image, check to make certain it includes everything necessary. An image should contain as much of the sentence content as possible.

   b. If part of the sentence content is left out of your image, it might be forgotten. If content is missing, adjust your image and continue. If your image is comprehensive, continue.

5. REPEAT Read the next sentence and repeat Steps 1-4.

The students first implemented these procedures in ability-level material before using them in grade-level material.

Self-questioning strategy procedures. The Self-Questioning Strategy also was designed to facilitate reading comprehension by teaching the student to form questions as s/he reads to maintain interest and enhance recall. Students followed these procedures:

1. Read the title (or subtitle). Ask yourself as many "WH" questions as you can that relate to this title (or subtitle).
2. Mark the answer to each question when you find it in text with the appropriate symbol.
3. Ask new questions as you read to help yourself keep reading.
4. Mark the answers.

Before students began applying the Self-Questioning Strategy, they were provided examples of five common types of "WH" questions: (a) who, (b) what, (c) where, (d) when, and (e) why. Symbols were identified for each type of question so students could mark the answer to a specific question when it was located in the text. For example, a clock face ( ) was used for "when" questions.

During the modeling instructional step, the teacher identified cues in the text that would help the student formulate appropriate questions at appropriate times. For example, the teacher would indicate that when a date was included, it was a good time to ask a "What happened on this date" question.

Testing procedures and measurement. Seven tests were given the students before and after training (described as Steps 1 and 9 above). Four tests measured the students' skills related to visual imagery in ability- and grade-level materials. All tests were individually administered. For the first two tests, students were asked to read a 100-200 word passage (one at ability level and one at grade level). Each student was told that s/he would be asked to tell the teacher about the content when s/he finished reading. The student was allowed as much time as s/he needed to read the passage; the time was recorded by the teacher. When the student finished reading, the teacher instructed him/her to "tell me about (story title)." The student's verbal recall was recorded and checked with the passage to determine the percentage of information correctly recalled. After the free recall, the student was asked to answer 6-10 comprehension questions about the passage. The student's score was the percentage of correct responses to questions. After the student told what s/he remembered, s/he was asked "how did you remember this information, and the strategies the student used were recorded. Two more tests (one ability level, one grade level) then were administered with a slight modification in the instructions. The student was directed to read the passage and try to form an image of the story as s/he read. The testing then proceeded as described above.

Three tests were given to assess students' self-questioning skills. First, the student was asked to read two passages (one ability level, one grade level) of approximately 200 words and answer 6-10 comprehension questions. The student's score was the percentage of correct responses to the questions. Then, the student was asked to read a third passage at his/her ability level. S/he was directed to place a check mark at the end of every fourth or fifth line so the teacher would know the student's progress in the reading passage.

In addition, the student was instructed to ask questions about the material that would make him/her interested in what s/he was reading. As the student read and marked the passage, the teacher asked (up to five times), "Have you asked yourself any questions about what you have read?" If the student responded affirmatively, s/he was asked to relate those questions. For each question, the teacher recorded the type of question and whether it was related to the content of the passage. If the student had asked himself/herself no questions, the teacher also recorded that information.

Interobserver reliability was determined by having a second teacher independently observe the student or grade the teacher's record of the student's responses once before training and once after training for each kind of test for each student. The two teachers' recordings were compared item-by-item. An agreement was scored if both teachers recorded a particular behavior or response exactly the same. The percentage of agreement was calculated by dividing the number of agreements by the number of agreements plus disagreements and multiplying by 100. On the Visual Imagery tests, there were 99 agreements out of 106 opportunities to agree (93.4% agreement); on the Self-Questioning tests, there were 58 agreements out of 60 opportunities to agree (96.7% agreement).

Experimental Design

A multiple-baseline design across the two strategies was employed for each student. Four students were taught the Visual Imagery Strategy followed by the Self-Questioning Strategy. These students received all seven tests in baseline and then the first strategy, Visual Imagery was taught. When the students reached criterion on Visual Imagery, the Self-Questioning tests were given again. If a student's baseline had remained stable, Self-Questioning was taught. If the baseline was not stable, other Self-Questioning tests

were administered until a stable baseline was achieved. Then the strategy was taught. When a student reached criterion on Self-Questioning, all three Self-Questioning tests and the four Visual Imagery tests were administered again. Two students were taught the Self-Questioning Strategy followed by the Visual Imagery Strategy.

Results

Figure 1 shows the test results and practice results for a ninth grade student, Carl (Student 1). Carl was taught the Visual Imagery Strategy (top graph) followed by the Self-Questioning Strategy (second graph). Scores achieved in ability-level materials are plotted with circles, and scores achieved in grade-level materials are plotted with squares. Data graphed for the Visual Imagery Strategy are the percentage of comprehension (questions correctly answered) for pre- and post-tests and the percentage of information given during free recall for the training sessions. For the Self-Questioning Strategy, the percentage of comprehension is recorded for pre-and post-tests, and the percentage of content-related questions asked by the student during the probes is recorded for the training sessions.

Insert Figure 1 about here

During baseline in Visual Imagery, when he was not prompted to form a visual image, Carl correctly answered 20% of the comprehension questions (plotted with a closed circle) related to the passage at his reading ability level (fifth grade) and 50% of the questions (plotted with a closed square) about a grade-level passage (ninth grade). When he was directed to form a visual image, he scored 30% on an ability-level passage (open circle) and 33% on a grade-level passage (open square).

After the Visual Imagery Strategy was introduced, Carl required only three practice sessions in ability-level materials and four practice sessions in grade-level materials to meet criterion in using the strategy. The posttests showed that he improved his comprehension scores from baseline in all four tests. These improvements were maintained on the final post test. Carl was especially skilled when asked to apply the strategy to grade level materials; he answered 100% of the questions correctly in this case.

During baseline in the Self-Questioning Strategy, Carl correctly answered 33% of the questions on an ability-level passage and 50% of the questions on a grade-level passage. When he read an ability-level passage and the teacher probed to see if he was asking questions, he asked no questions during the first pretest and an average of .2 questions per probe when tested after Visual Imagery Strategy instruction. After the Self-Questioning Strategy was introduced, Carl required only four practice sessions in ability-level materials and three practice sessions in grade-level materials to meet criterion in using the strategy. The posttest showed that he not only had improved his conprehension of grade-level materials but also increased the number of questions asked per probe. He now asked an average of 2.2 content-related questions per probe on the posttest.

Thus, Carl did not use either strategy to criterion (85% or higher comprehension of the passage) until he received specific training on each strategy. His use of the strategies allowed him to remember more information from reading passages and to perform better on comprehension tests of grade-level passages.

Figures 2, 3, and 4 show results for three other students who received Visual Imagery Strategy instruction followed by Self-Questioning Strategy instruction. Figures 5 and 6 show results for two students who received Self-Questioning

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Insert Figures 2, 3, 4, 5, and 6 about here

Strategy instruction followed by Visual Imagery Strategy instruction. All results are similar to Carl's results. All students mastered the strategies in ability-level materials and (with one exception) were able to apply the strategy to improve their comprehension of grade-level materials. Student 3, Paula (Figure 3), did not reach criterion in applying either strategy to grade-level materials. All other students learned to apply the strategies to grade-level material with a maximum of four practice sessions. The students' use of the strategies resulted in greater comprehension scores from the pretest in baseline to the posttest after training.

For students who mastered the two strategies, the maximum number of practice sessions required was seven. The number of practices for each strategy ranged from one to four across the five students who mastered the strategies.

The instructional time needed to present each of the two strategies (Steps 2-4) was as follows: Visual Imagery, three to four hours; and Self-Questioning, three to four hours. Visual Imagery and Self-Questioning practices took about 15-20 minutes each. Thus, Carl received about six hours of instruction to learn the Visual Imagery Strategy and six hours to learn the Self-Questioning Strategy. The total instructional time for the other students ranged from five to seven hours.

Discussion

The results of this study support the conclusion that learning disabled students can be taught to use strategies designed to increase their reading comprehension. They can apply these learning strategies in material written above their measured reading ability level. Six replications of a multiple-baseline design demonstrated that improved performance did not occur until each strategy had been specifically taught. Once the individual strategies were taught, the students could apply them to increase their comprehension in both reading ability-level and grade-level passages.

These results support data available in the literature regarding the effectiveness of visual imagery (Kerst & Levin, 1973; Lesgold et al., 1975; Paivio, 1969) and questioning (Manzo, 1969; Robinson, 1946). Specifically, these data support Warner's (1977) results using visual imagery with LD adolescents, Hori's (1977) results using Manzo's ReQuest procedure with LD adolescents, and Wong's (1980) results using a questioning/prompt procedure with LD second and sixth graders.

Analysis of the data indicates that implementation of one strategy does not affect performance on the other regardless of the order of instruction. The two strategies are independent and each must be specifically taught.

One disturbing element in the data presented here is the performance of Student 3, Paula. Although she achieved mastery of the two strategies in reading ability level material, she was unable to apply the strategies in grade-level material. Although the reasons for this difficulty are not known, Paula demonstrated a greater difference between ability level (fourth grade) and grade placement level (ninth grade) than any other student to whom these strategies were taught. A prerequisite for instruction in these two strategies is reading level of at least fourth grade. Although Paula met this prerequisite, it is possible that the leap from fourth grade to ninth grade materials is too great. Further research should investigate the effects of varying differences between ability and grade level on learning these strategies. If similar difficulties are experienced by other students, intermediate steps may need to be added. For example, Paula might have been asked to apply the strategies first at her ability level (fourth grade), then at an intermediate level (seventh grade), and finally at her grade placement level (ninth grade). Another possible explanation for Paula's difficulty in applying the strategy to grade-level material may be that she lacked knowledge of the vocabulary required in grade-level material.

Although the results of this study are promising, caution must be exercised in interpreting the results. These results are based on the successful performance of five students. They should be replicated with additional students before statements about the generality of the results can be made. All students in this study were reading at fourth grade level or higher. Application of these finding to LD students with reading levels below fourth grade level should await further research.

Two other areas appear fruitful for future research. Although the specific methodology and the strategies implemented here were effective with five of six students, future research should examine whether alternative procedures are successful when a great difference (five years or greater) exists between reading ability level and grade placement level.

During implementation of these strategies, no attempt was made to teach LD students how to judge when to apply one strategy or the other. It is probable that the Visual Imagery Strategy may be more appropriately applied to some types of materials than to others. For other materials, the Self-Questioning Strategy may be the strategy of choice. Future research should attempt to teach students to evaluate material and select a strategy appropriate to the content.

The University of Kansas Institute for Research in Learning Disabilities is continuing its research related to these and other strategies. Topics of this continuing investigation are the effectiveness of learning strategies when implemented with small groups of students in resource rooms and and further analysis of the instructional methodology used to teach the Visual Imagery and Self-Questioning Strategies.

Notes

1. Test passages and reading ability practice passages were selected from 66 Passages to Develop Reading Comprehension and 88 Passages to Develop Reading Comprehension by M. Gilmore, A. Sack, and J. Yourman, published by College Skills Center, 1250 Broadway, New York. These materials were used because they contain a series of short, high-interest passages which have already been judged for readability. The readability of the passages in 66 Passages ranges from first to eighth grade and in 88 Passages ranges from sixth grade to college level.

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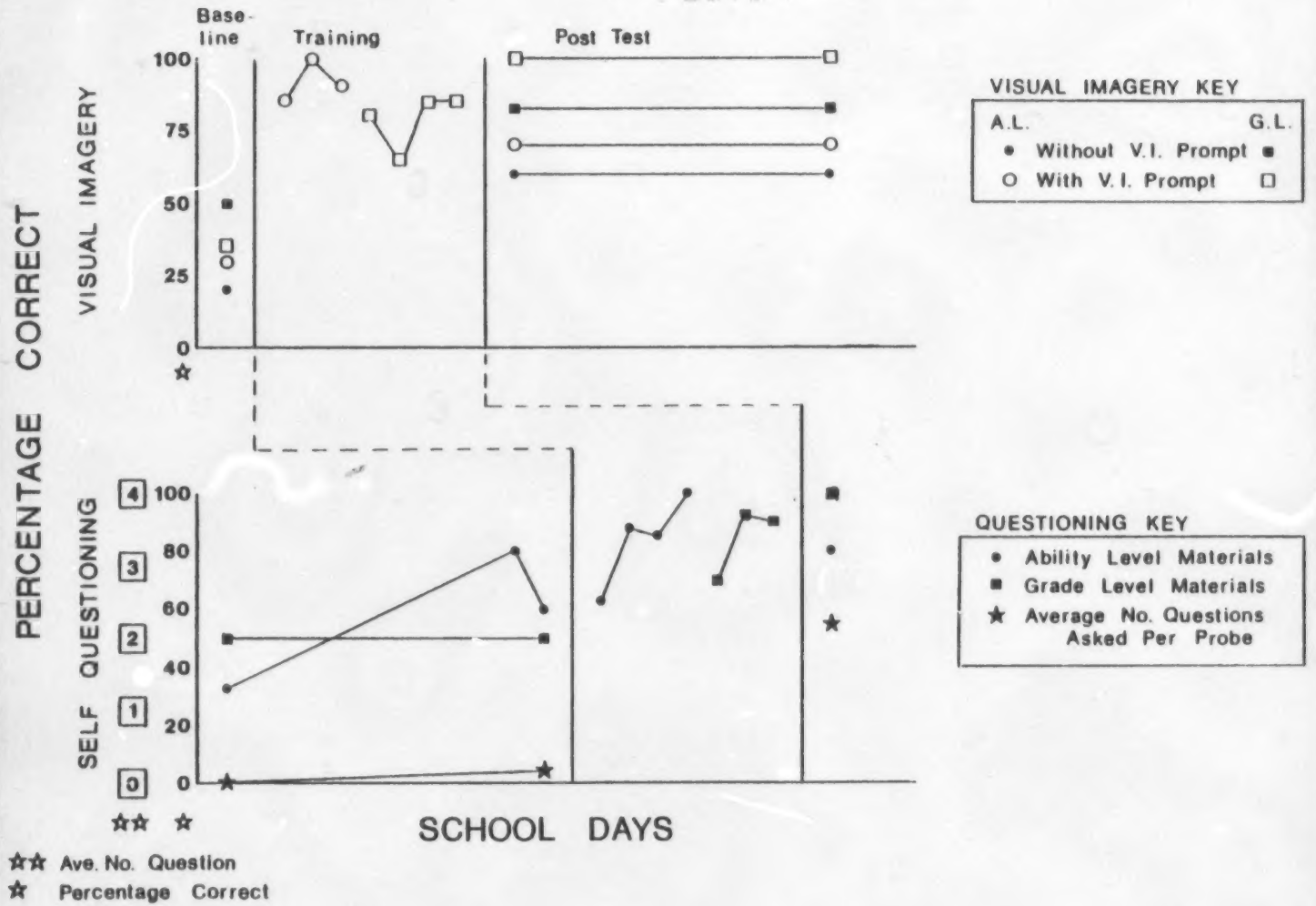
Figure 1

S_1


Base-line
Training
Post Test
PERCENTAGE CORRECT
VISUAL IMAGERY
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75
50
25
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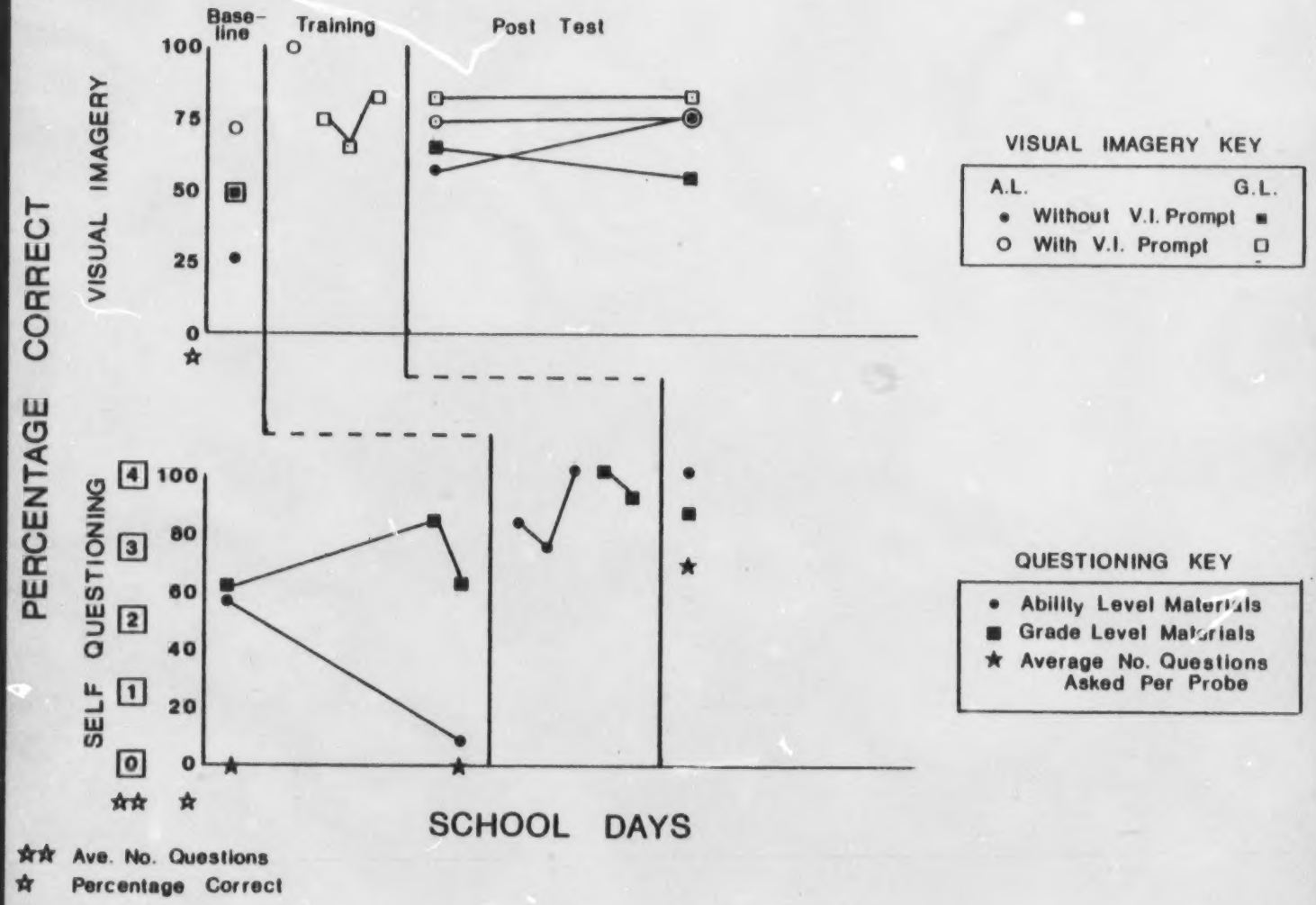
SELF QUESTIONING
4
3
2
1
0
100
80
60
40
20
0
SCHOOL DAYS
VISUAL IMAGERY KEY
A.L.
G.L.
Without V.I. Prompt
With V.I. Prompt
QUESTIONING KEY
Ability Level Materials
Grade Level Materials
Average No. Questions Asked Per Probe
Ave. No. Question
Percentage Correct

Figure 2

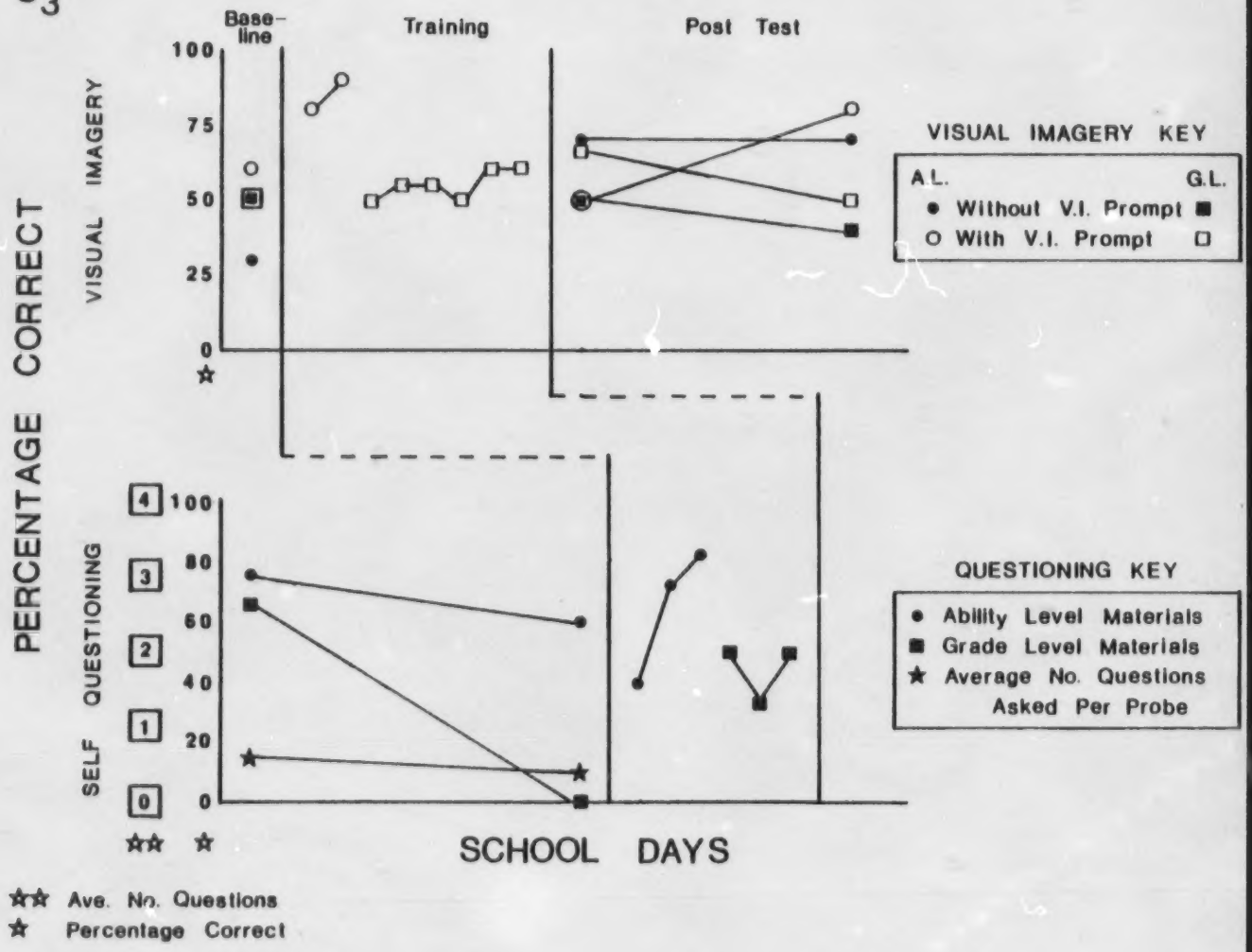
S_2



☆☆ Ave. No. Questions

☆ Percentage Correct

Figure 3


S3
Base-line
Training
Post Test
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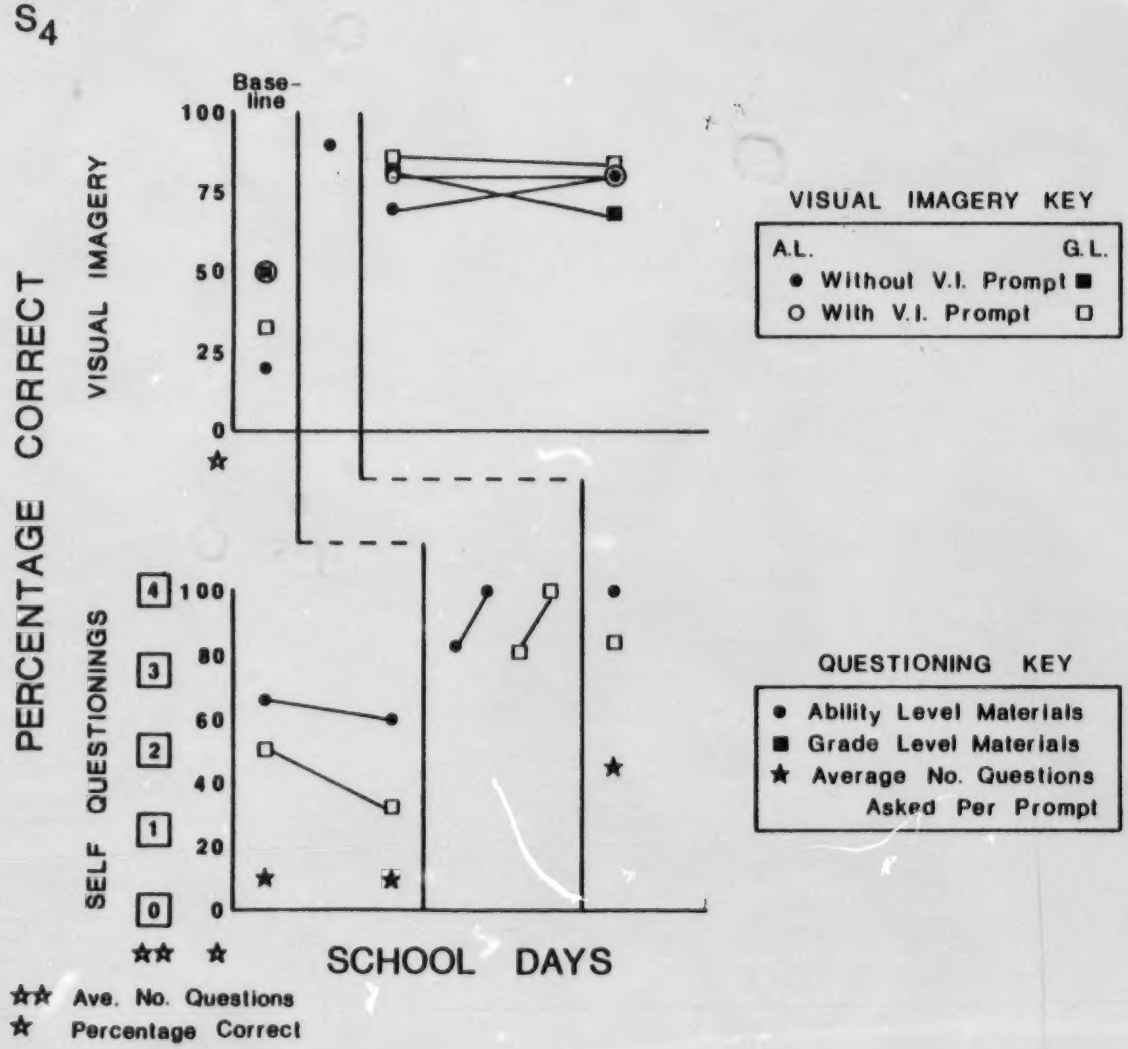
VISUAL IMAGERY
100
75
50
25
0
VISUAL IMAGERY KEY
A.L.
G.L.
Without V.I. Prompt
With V.I. Prompt
SELF QUESTIONING
4
3
2
1
0
100
80
60
40
20
0
QUESTIONING KEY
Ability Level Materials
Grade Level Materials
Average No. Questions Asked Per Probe
SCHOOL DAYS
Ave. No. Questions
Percentage Correct

Figure 4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Base-line
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50
25
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VISUAL IMAGERY
PERCENTAGE CORRECT
SELF QUESTIONINGS
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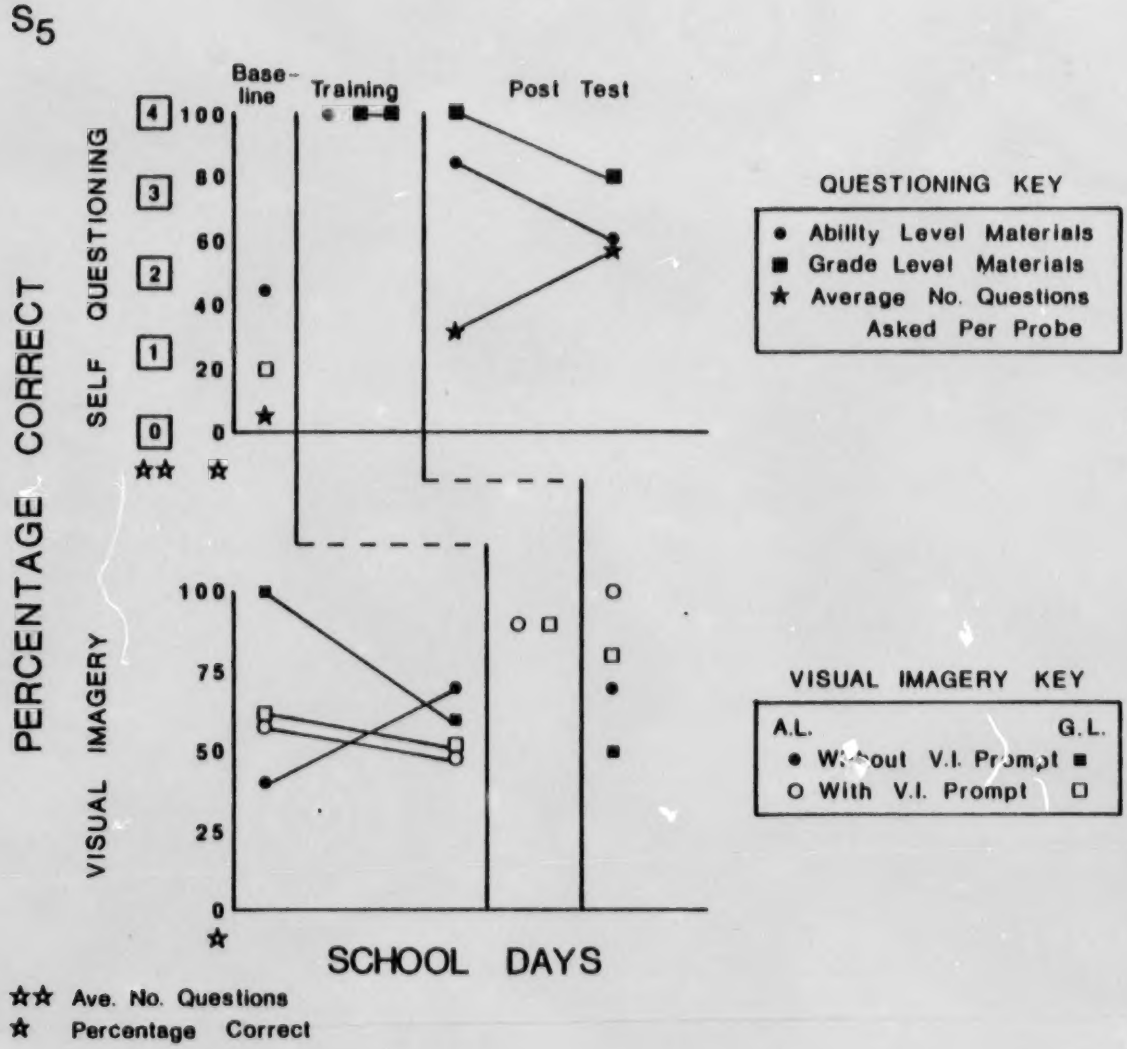
2
1
0
100
80
60
40
20
0
SCHOOL DAYS
VISUAL IMAGERY KEY
A.L.
G.L.
Without V.I. Prompt
With V.I. Prompt
QUESTIONING KEY
Ability Level Materials
Grade Level Materials
Average No. Questions Asked Per Prompt
Ave. No. Questions
Percentage Correct

Figure 5


S5
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Training
Post Test
PERCENTAGE CORRECT
SELF QUESTIONING
VISUAL IMAGERY
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60
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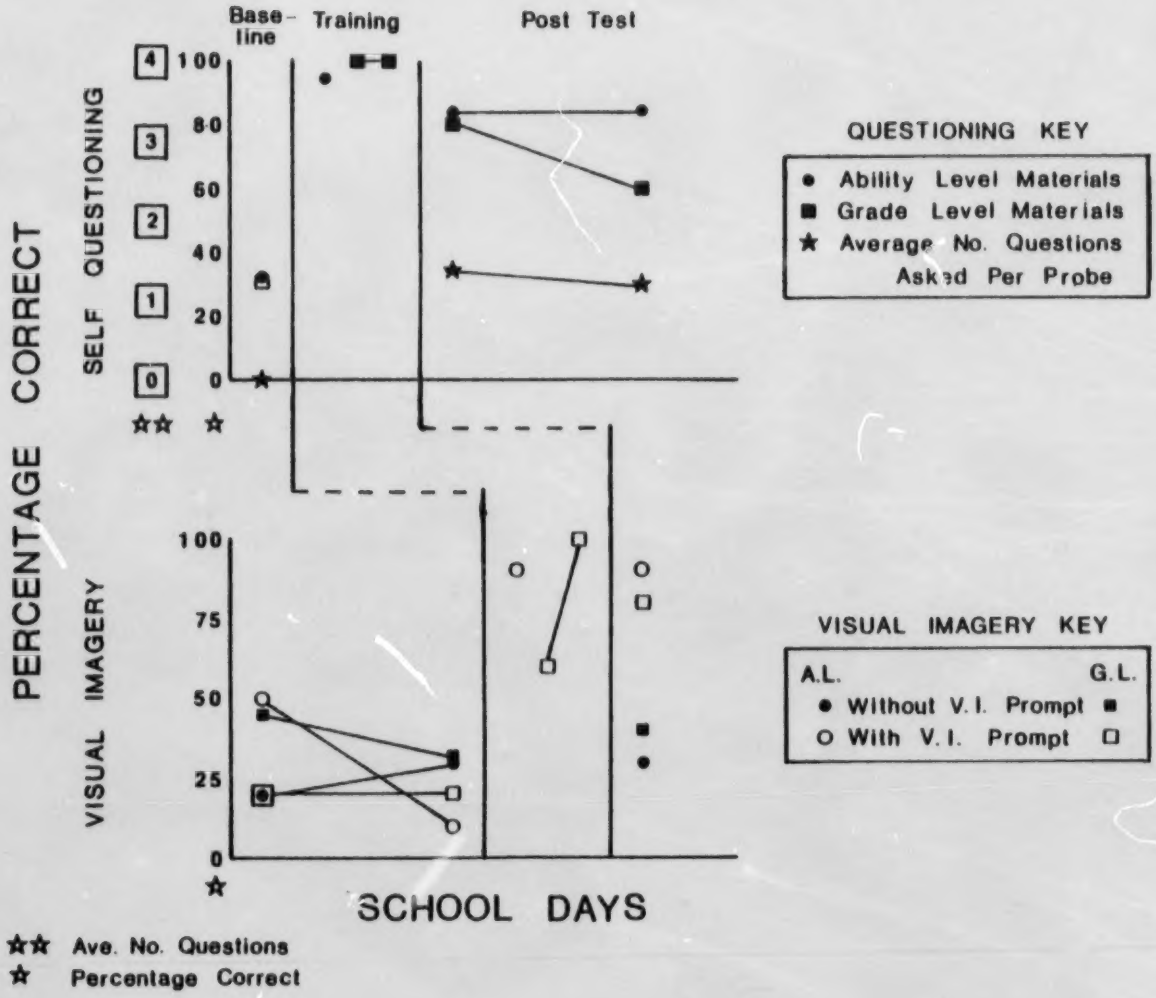
2
1
0
100
75
50
25
0
SCHOOL DAYS
☆☆ Ave. No. Questions
☆ Percentage Correct
QUESTIONING KEY
● Ability Level Materials
■ Grade Level Materials
★ Average No. Questions Asked Per Probe
VISUAL IMAGERY KEY
A.L. G.L.
● Without V.I. Prompt ■
○ With V.I. Prompt □

Figure 6


S6
Base-line
Training
Post Test
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SELF QUESTIONING
VISUAL IMAGERY
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75
50
25
4
3
2
1
0
SCHOOL DAYS
QUESTIONING KEY
Ability Level Materials
Grade Level Materials
Average No. Questions Asked Per Probe
VISUAL IMAGERY KEY
A.L.
G.L.
Without V.I. Prompt
With V.I. Prompt
Ave. No. Questions
Percentage Correct